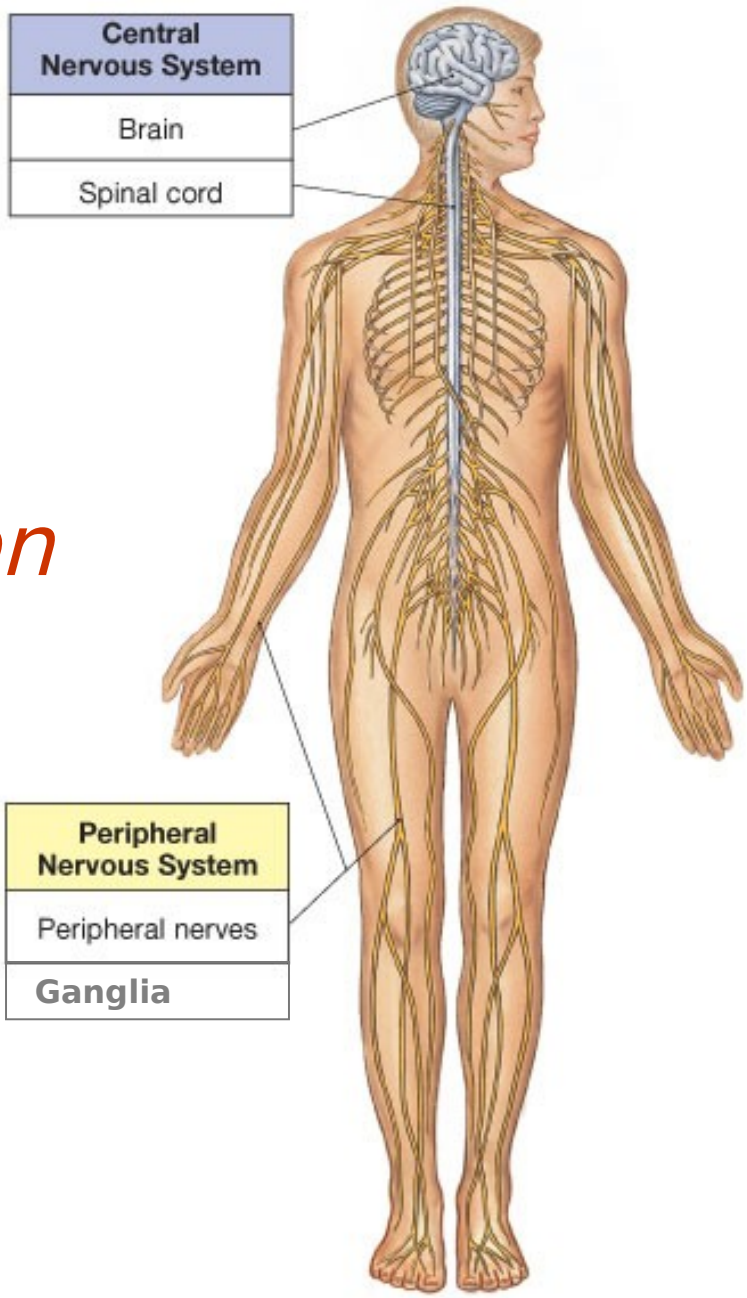
There are 2 types of cells in the Nervous System:

1) Neurons

Communication cell

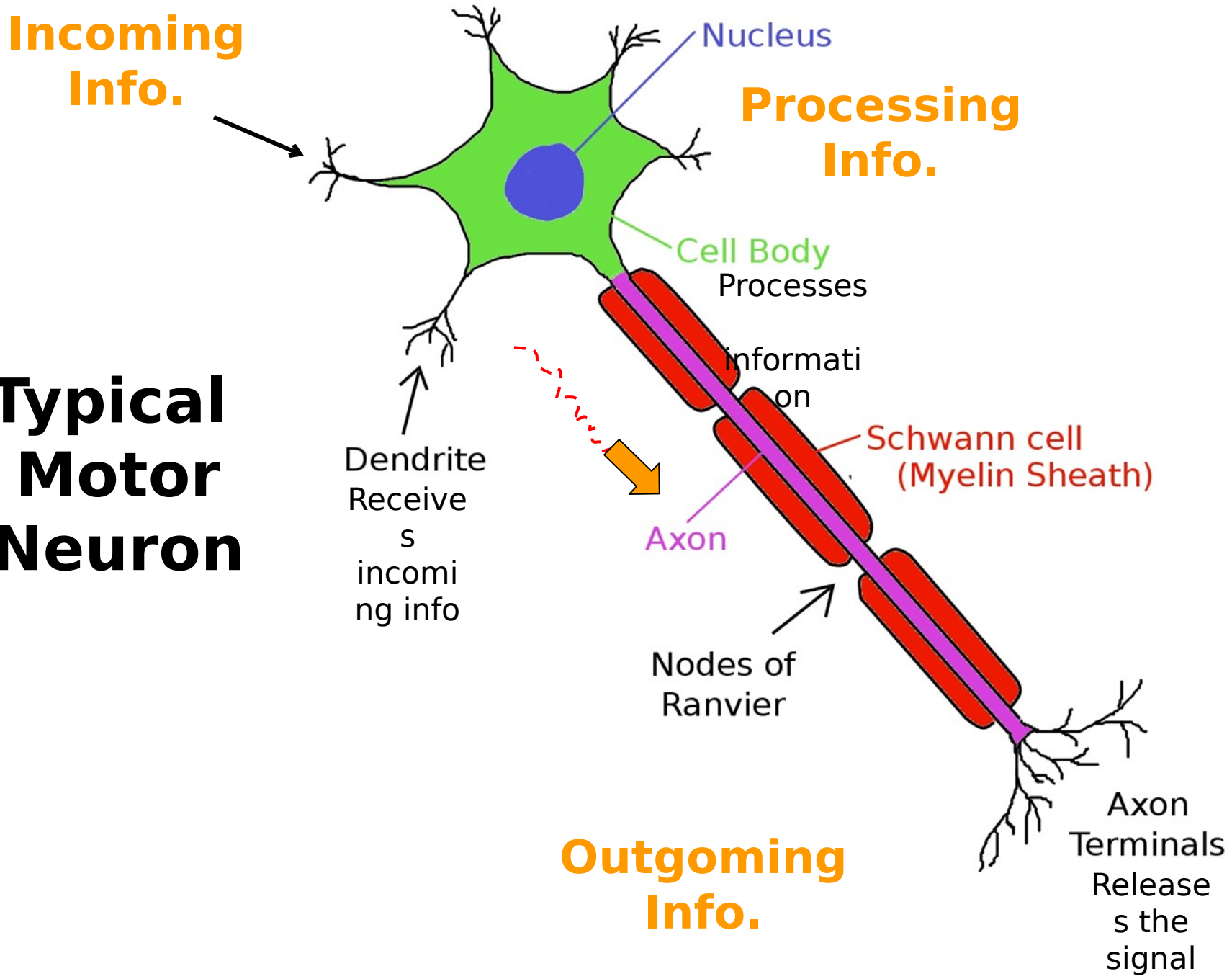
2) Glial cells

Support cell

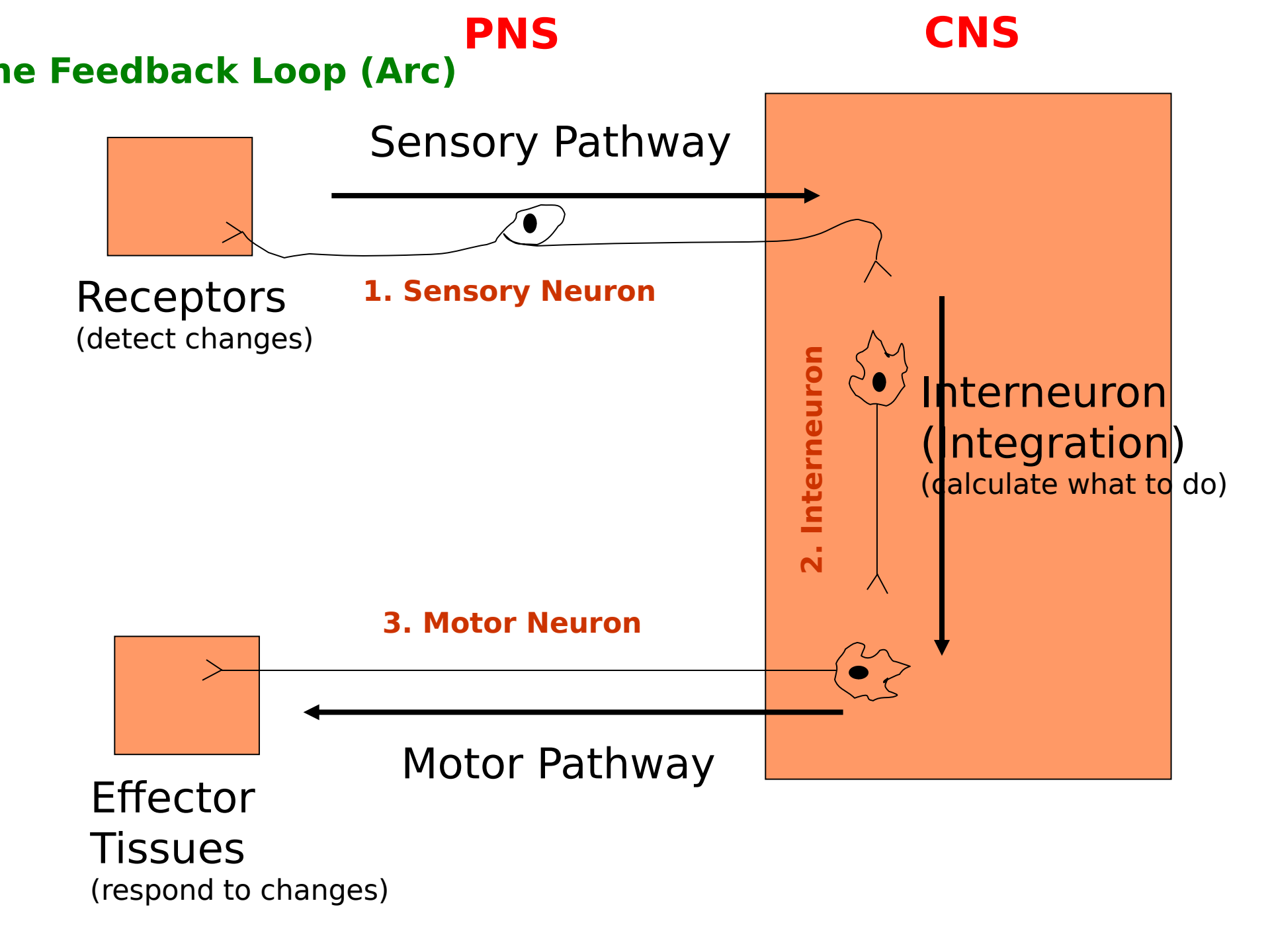


Which cells are most abundant?
How many different Glial cells are there?

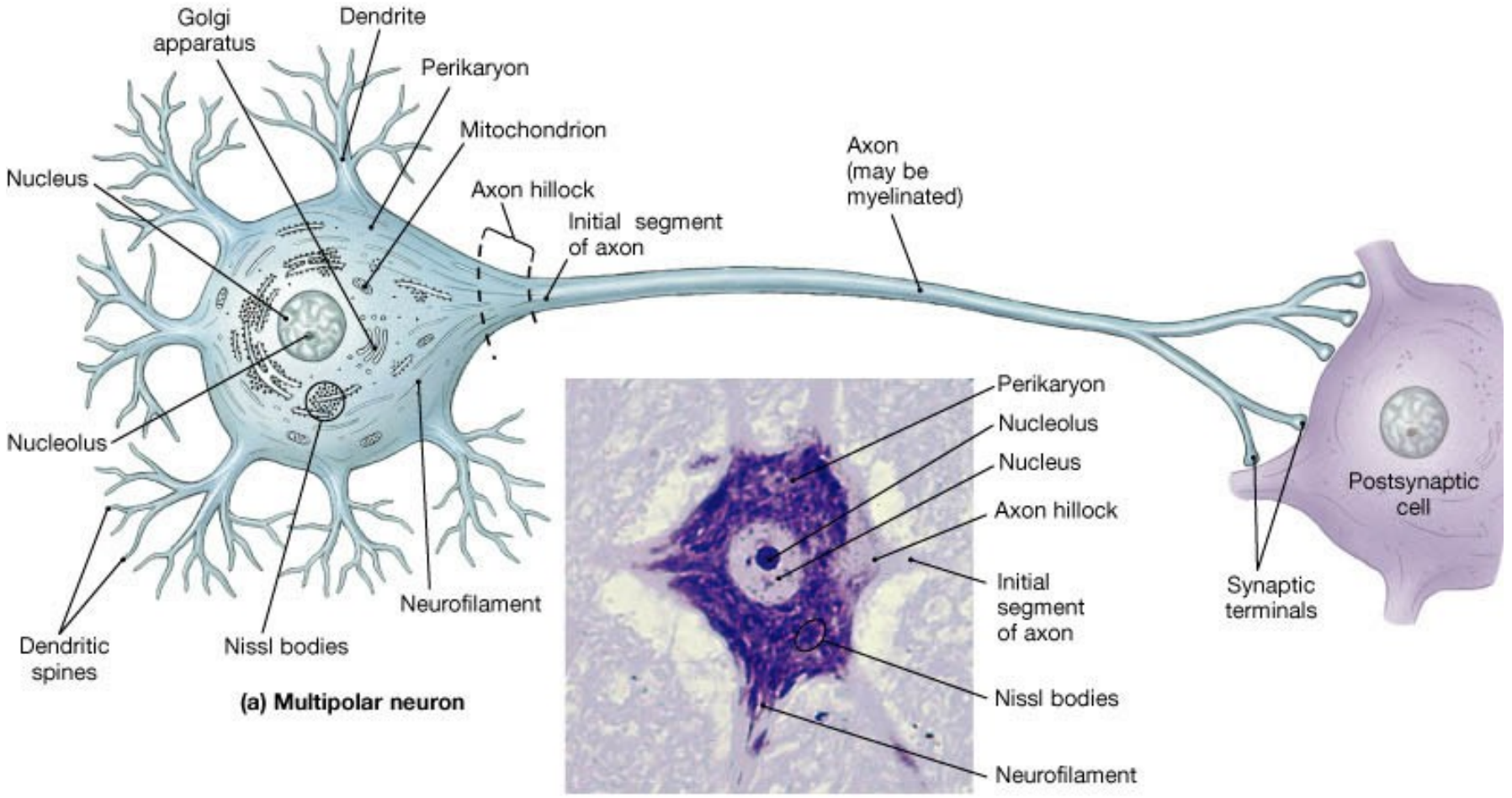
Typical Motor Neuron



ne Feedback Loop (Arc)

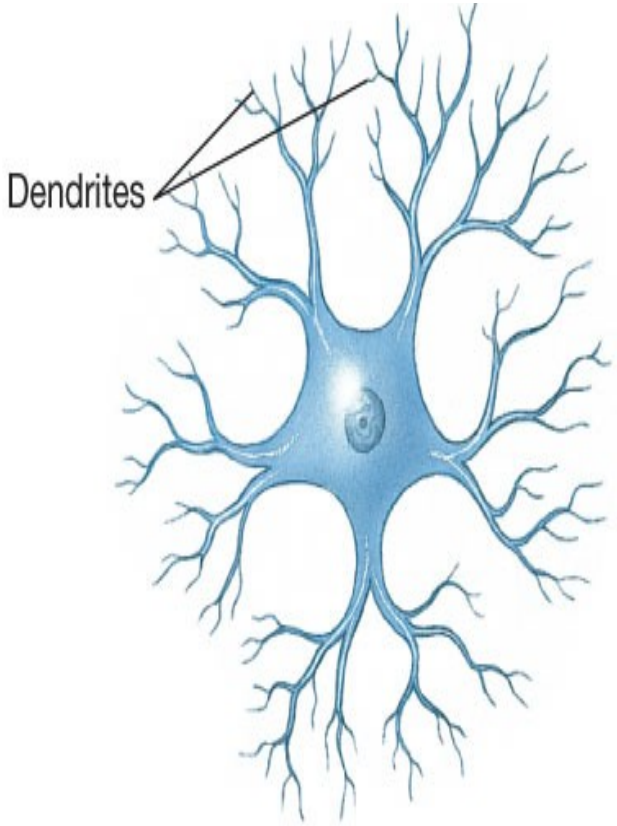


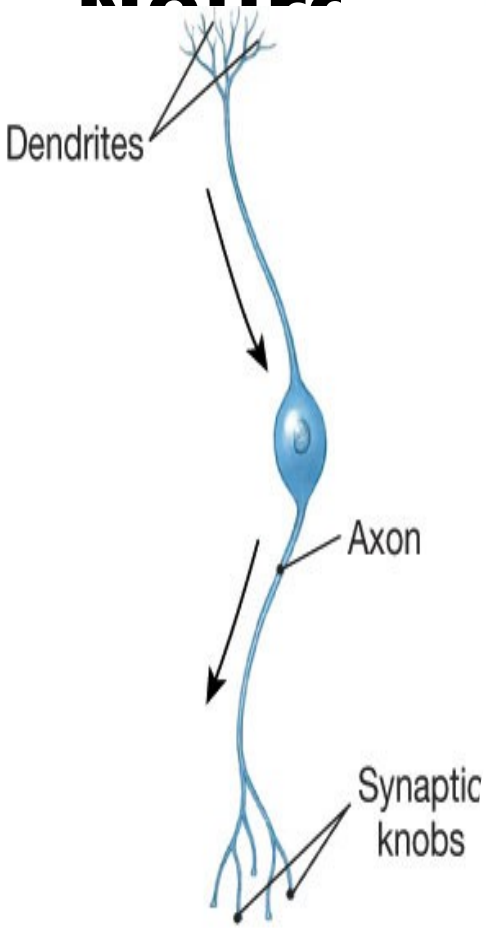
The Motor/Multipolar Neuron

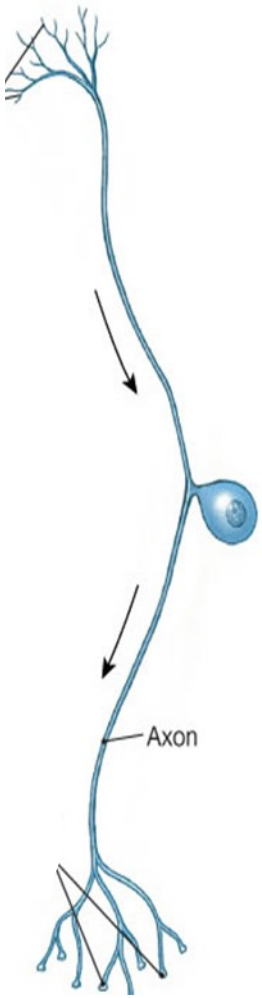


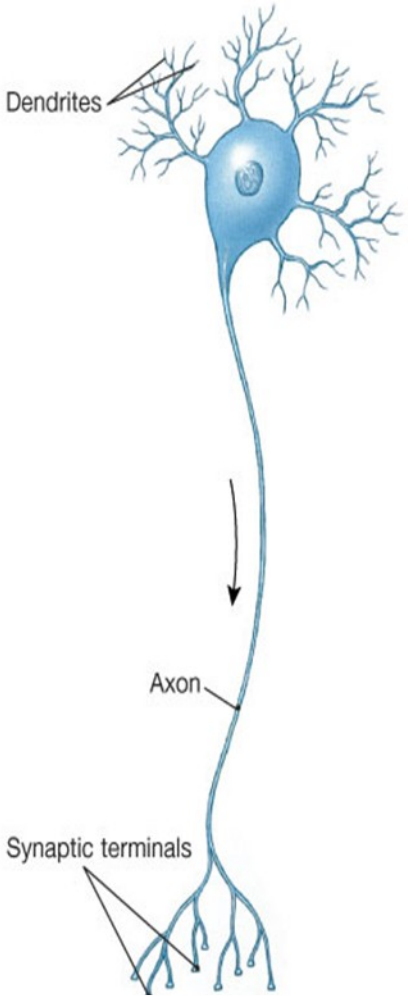
Histology of a Neuron

Important Anatomical Neurc



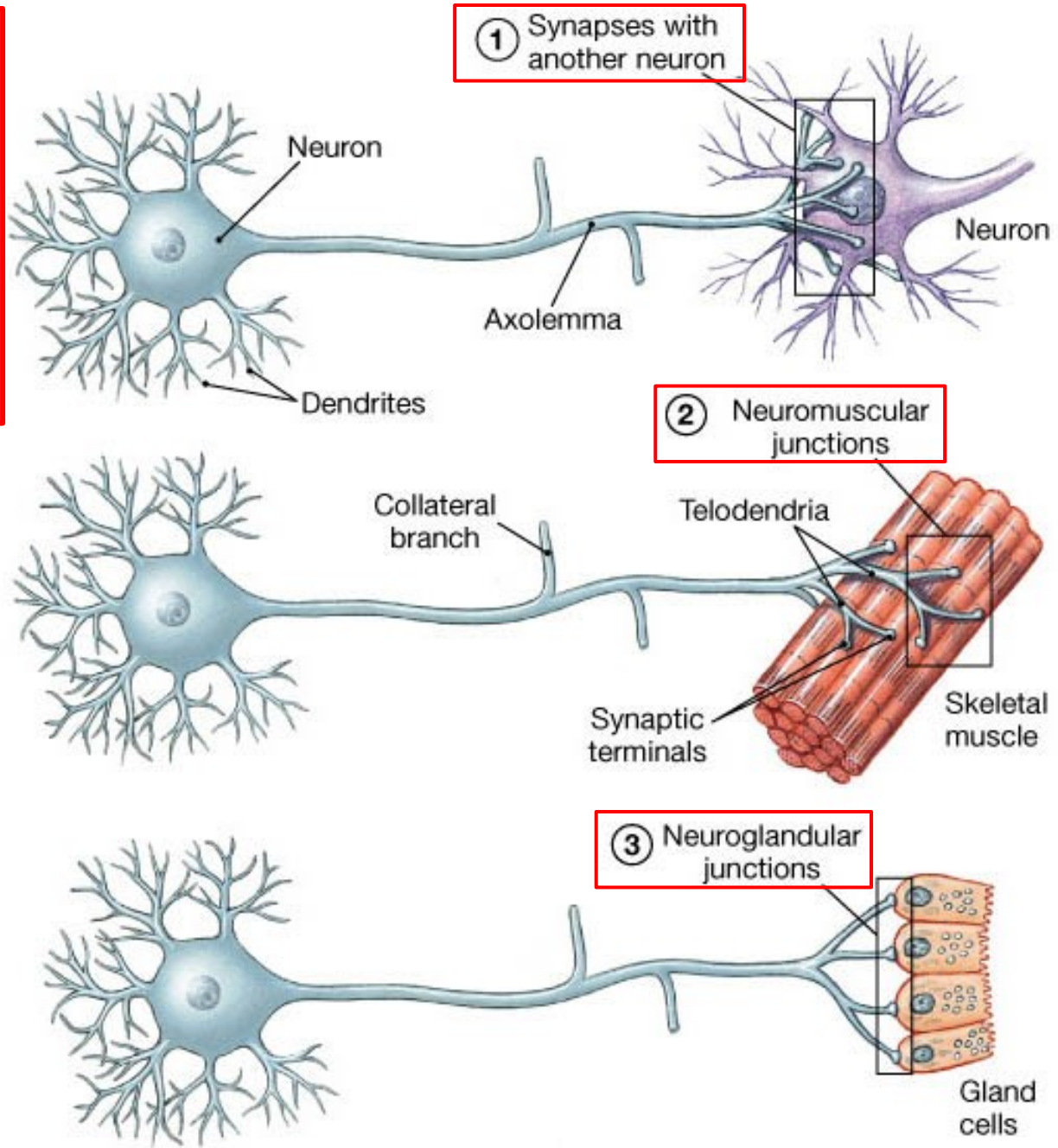




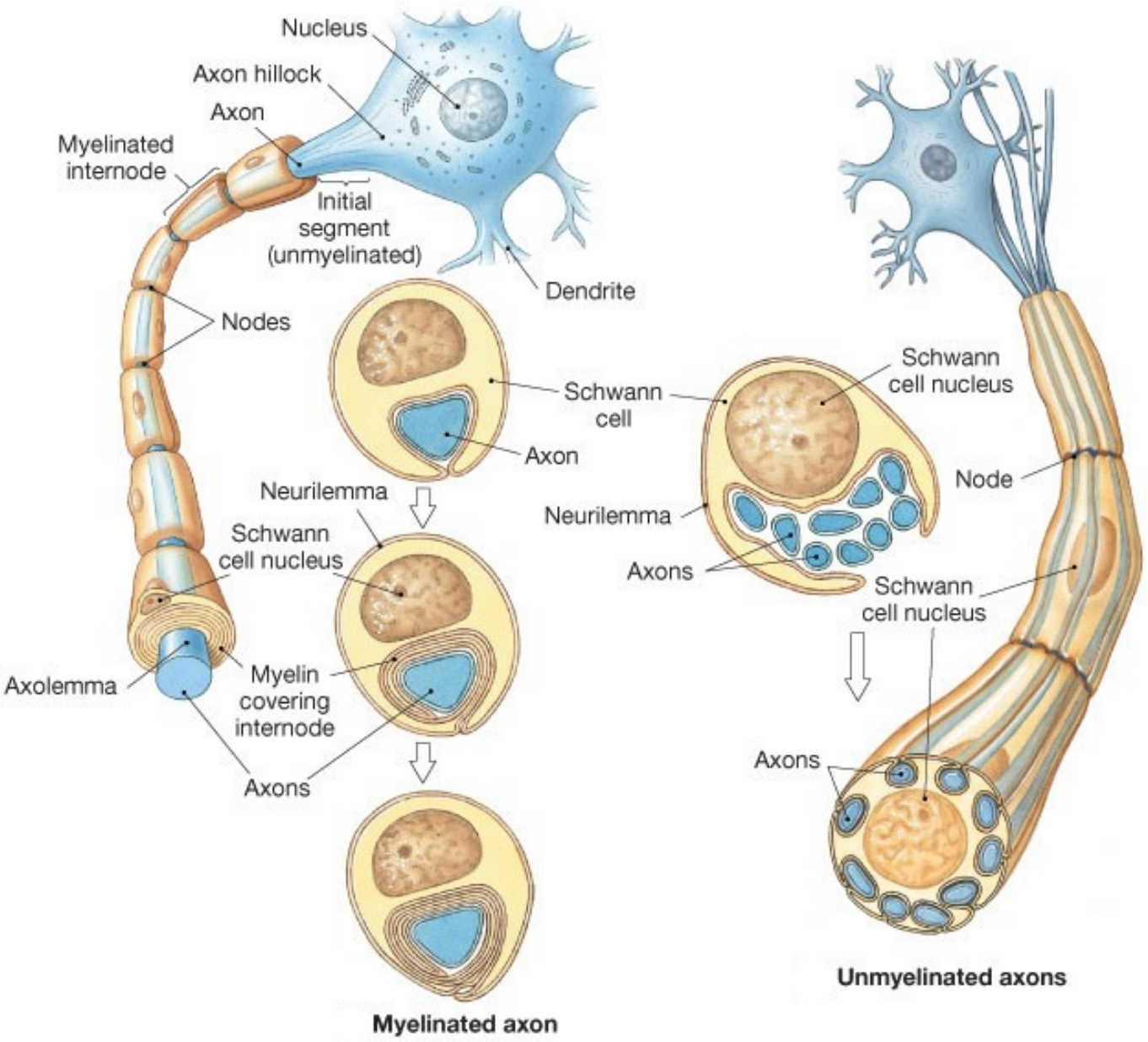


Anaxonic Bipolar Unipolar Multip

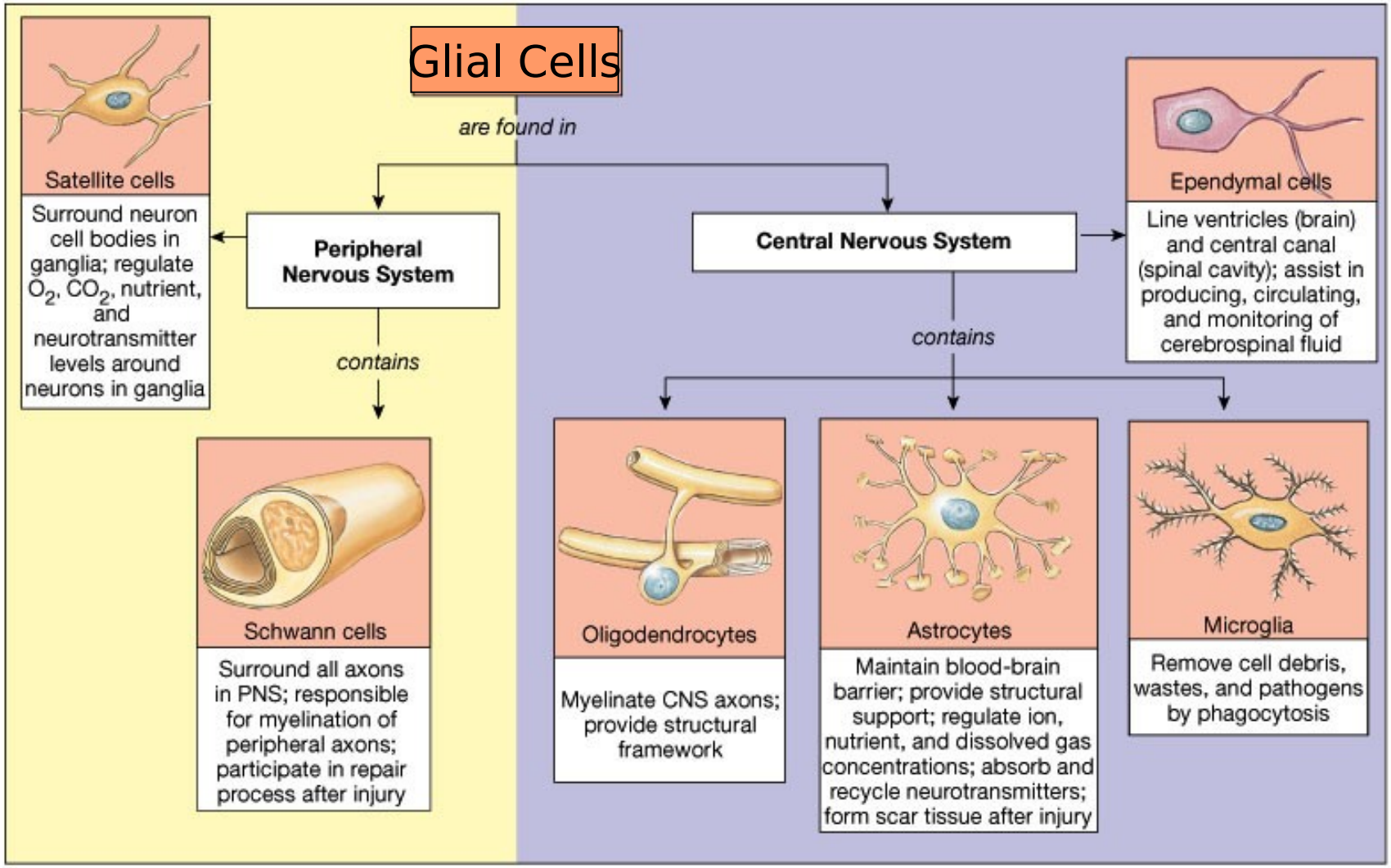
The **3** major types of **Communications Junctions** coming from Neurons



Axon Myelination



The Glial Cells


Glial Cells
are found in
Satellite cells
Surround neuron cell bodies in ganglia; regulate O_2, CO_2, nutrient, and neurotransmitter levels around neurons in ganglia
Peripheral Nervous System
contains
Schwann cells
Surround all axons in PNS; responsible for myelination of peripheral axons; participate in repair process after injury
Central Nervous System
Ependymal cells
Line ventricles (brain) and central canal (spinal cavity); assist in producing, circulating, and monitoring of cerebrospinal fluid
contains
Oligodendrocytes
Myelinate CNS axons; provide structural framework
Astrocytes
Maintain blood-brain barrier; provide structural support; regulate ion, nutrient, and dissolved gas concentrations; absorb and recycle neurotransmitters; form scar tissue after injury
Microglia
Remove cell debris, wastes, and pathogens by phagocytosis

Nervous System Terminology

Gray Matter – mostly nerve cell bodies.

White Matter – mostly myelinated axons.

Nerve fiber – a single axon of a neuron.

Nerve – a bundle of axons in the PNS.

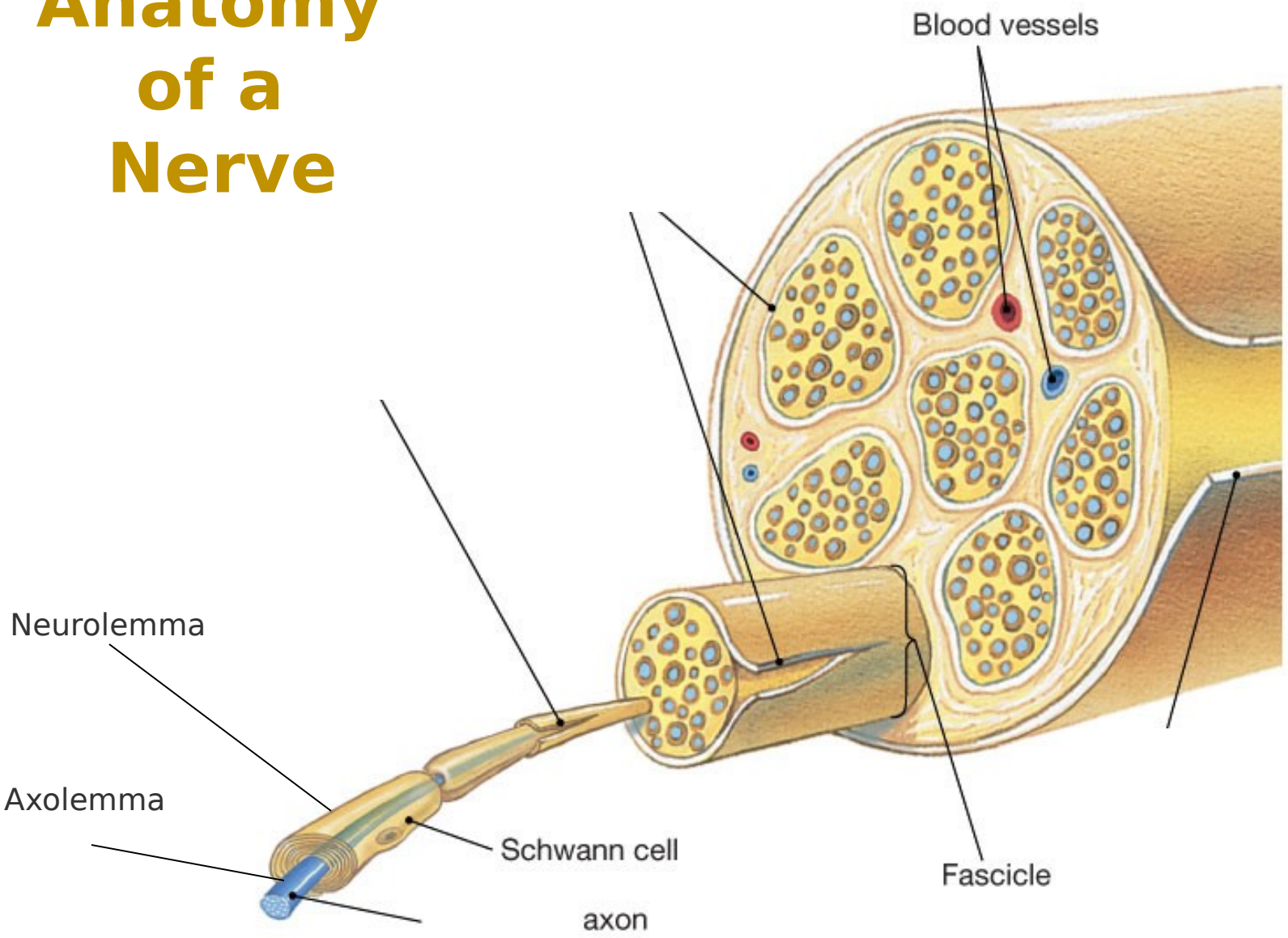
Tract – a bundle of axons in the CNS.

Columns – are groups of tracts.

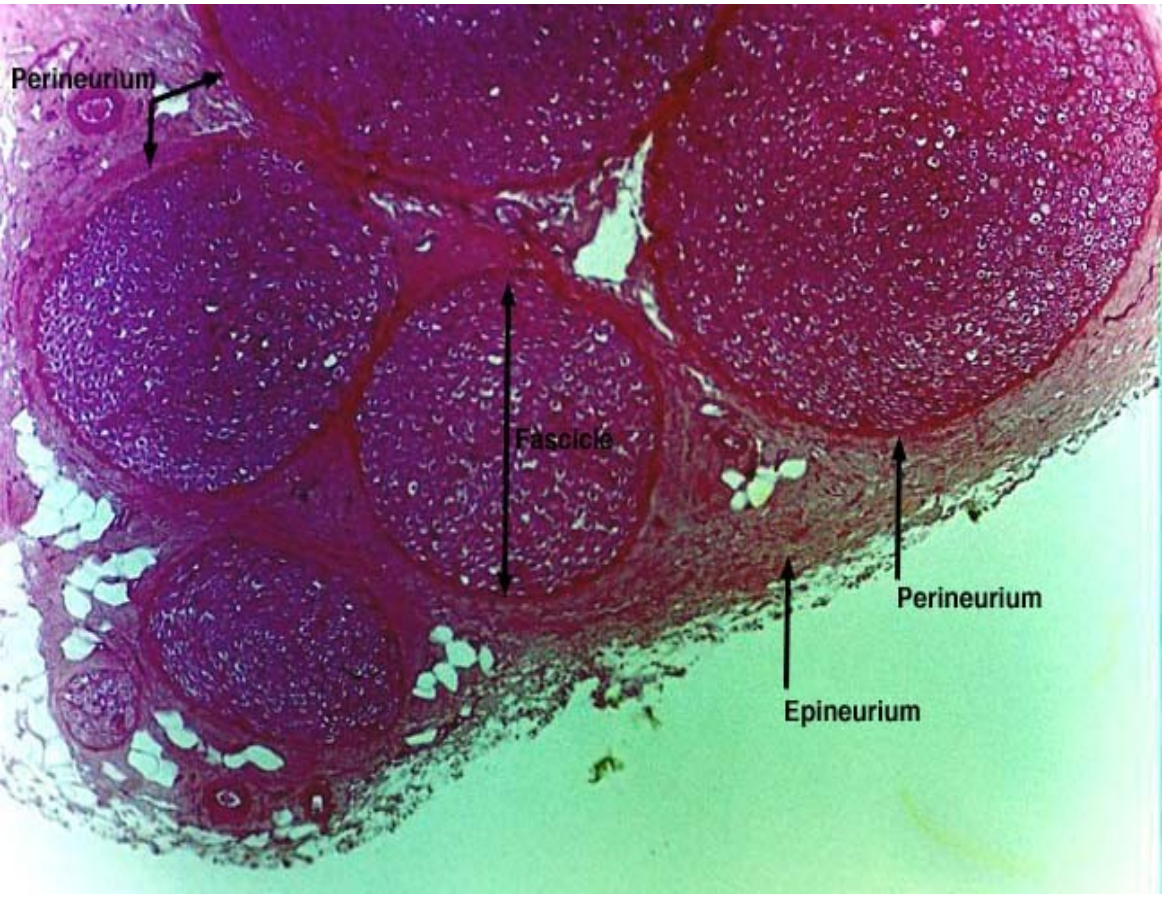
Ganglion – a cluster of nerve cell bodies in PNS.

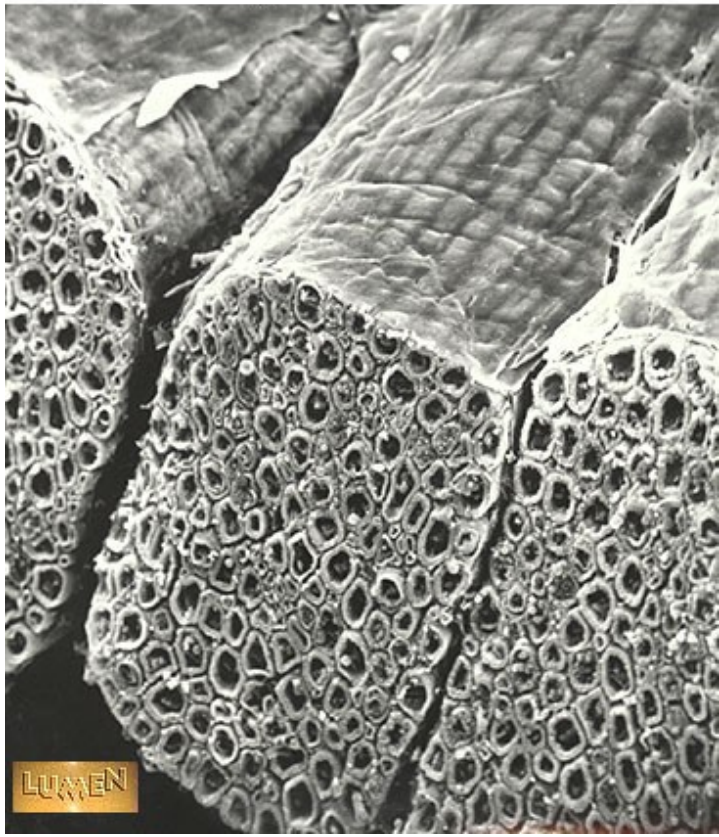
Nucleus – gray matter in CNS with discrete boundarie
and common function.

Anatomy of a Nerve

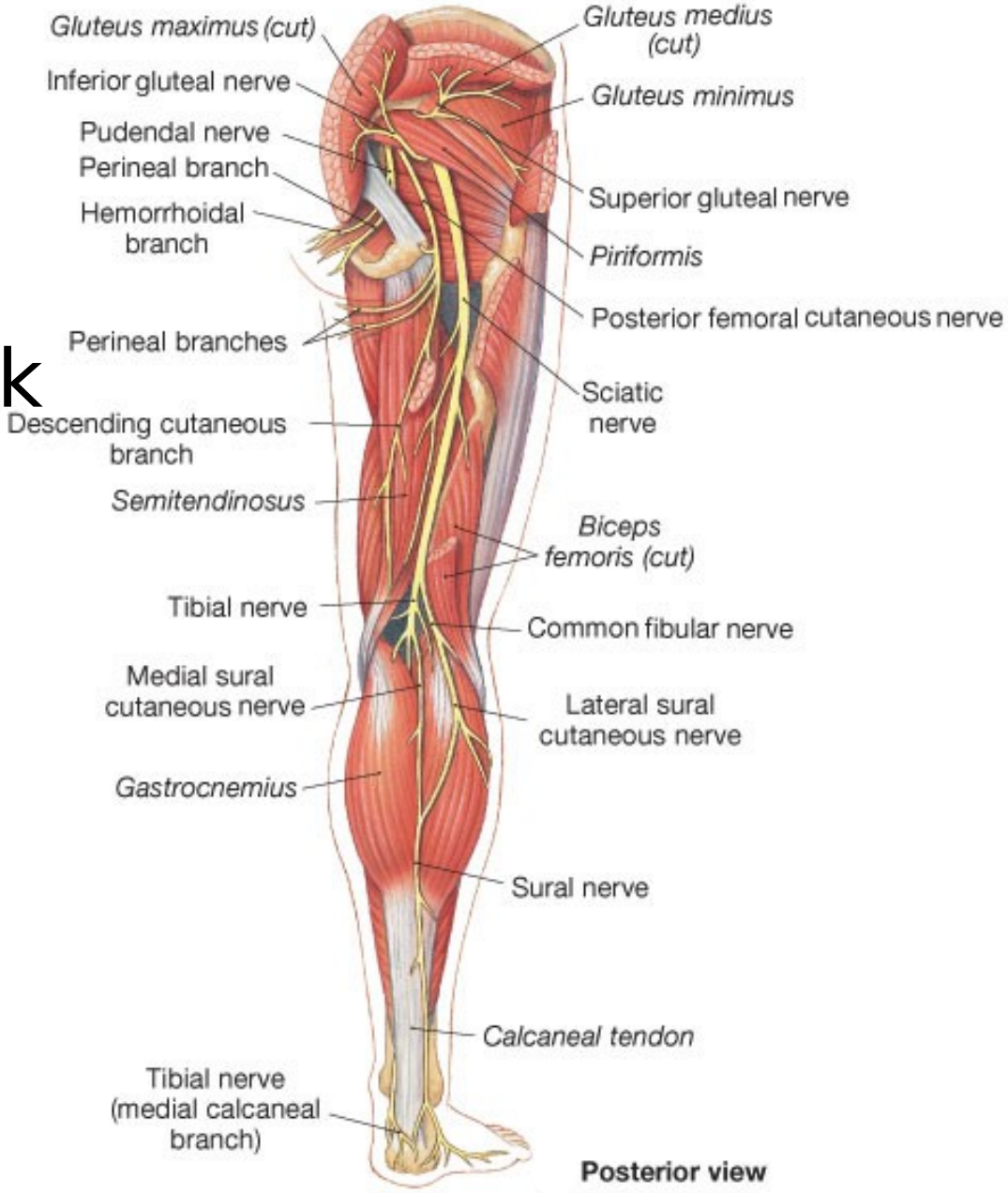


Histology of Nerves

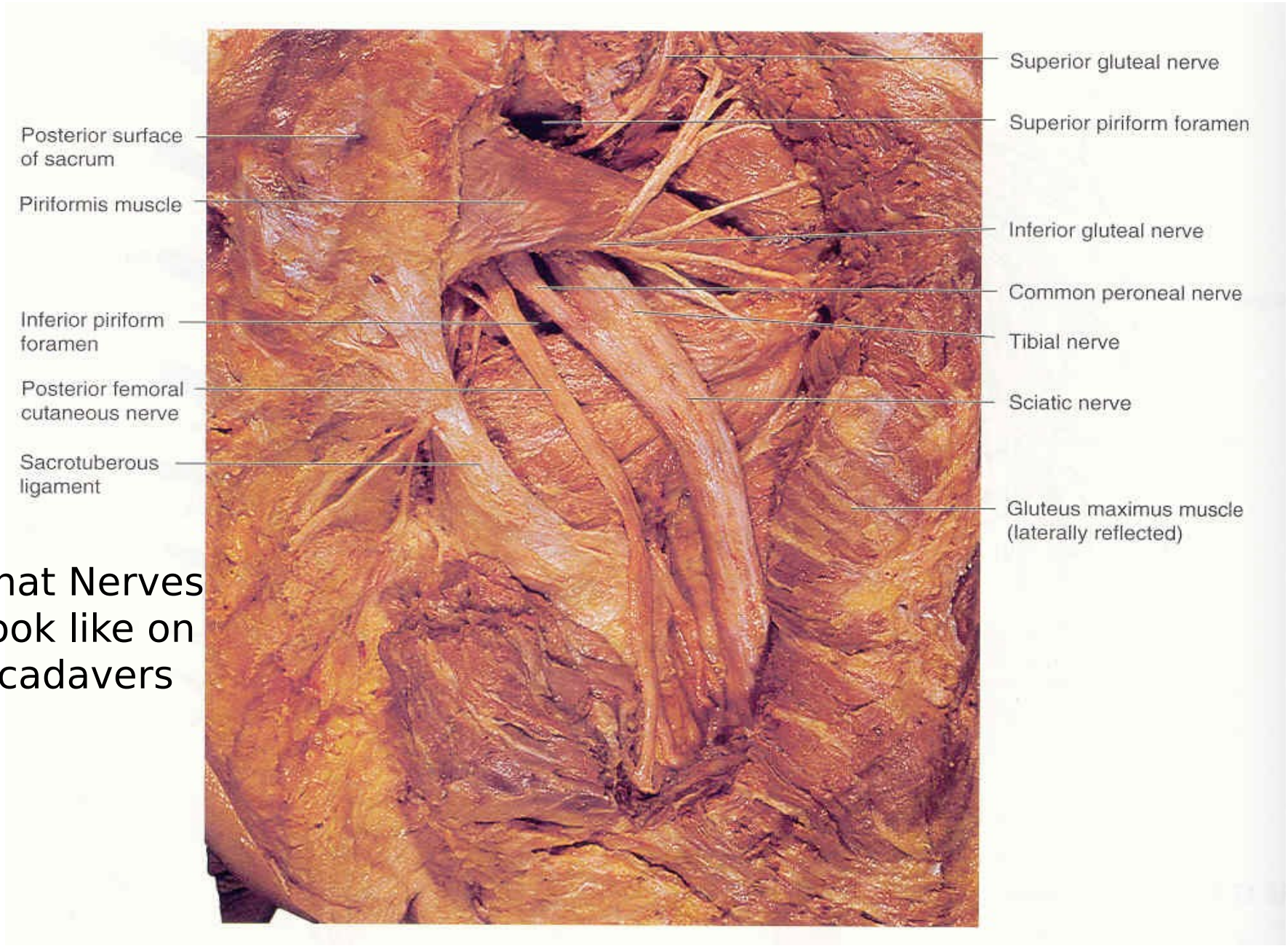


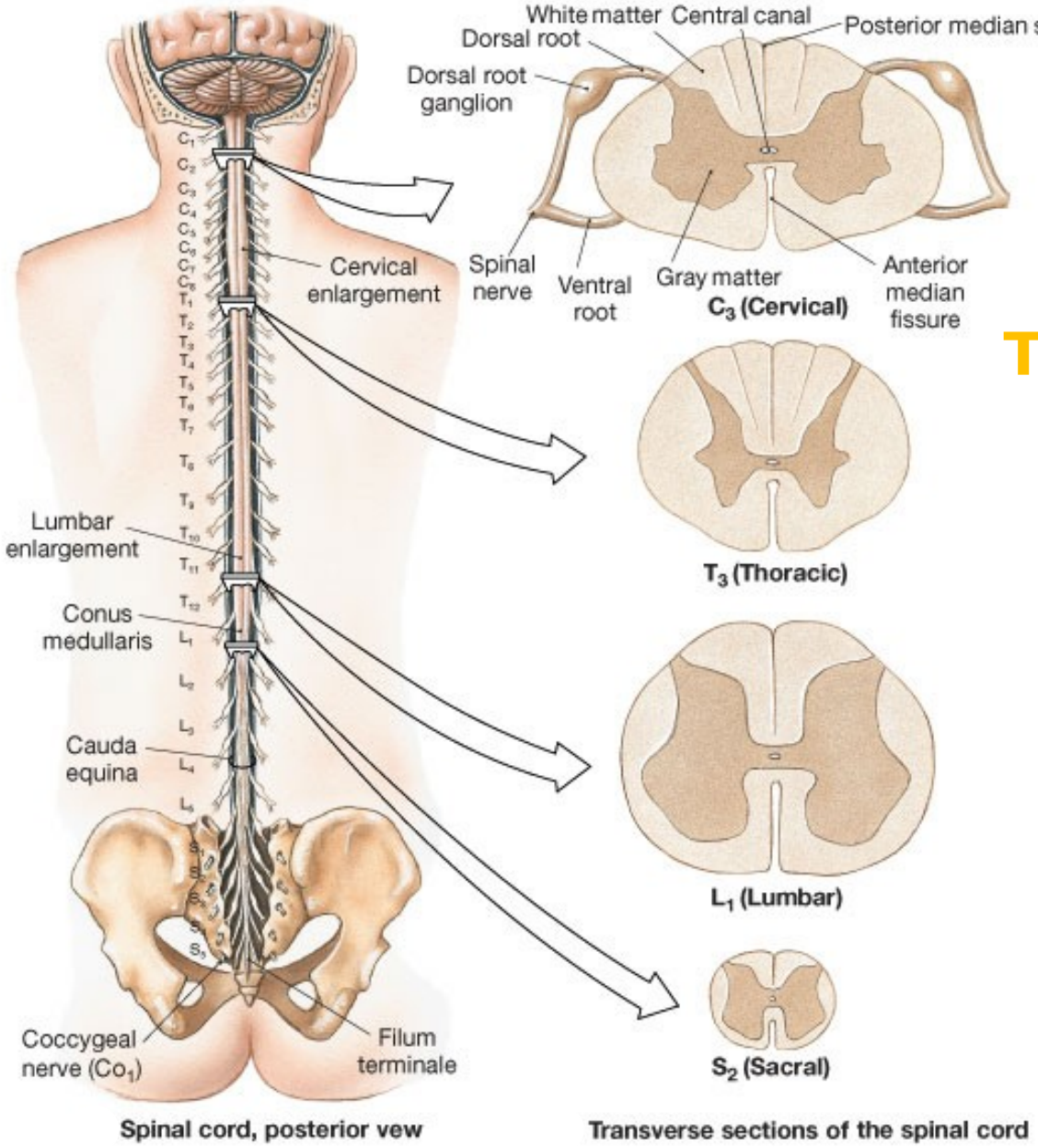


What Nerves look like on models



What Nerves look like on cadavers





In the Spinal cord:
White matter = columns
Gray matter = horns

There are 31 pairs of Spinal Nerves

8 Cervical (C_1-C_8)

12 Thoracic (T_1-T_{12})

5 Lumbar (L_1-L_5)

5 Sacral (S_1-S_5)

1 Coccygeal (Co_1)

Anatomical Features of the Spinal Cord

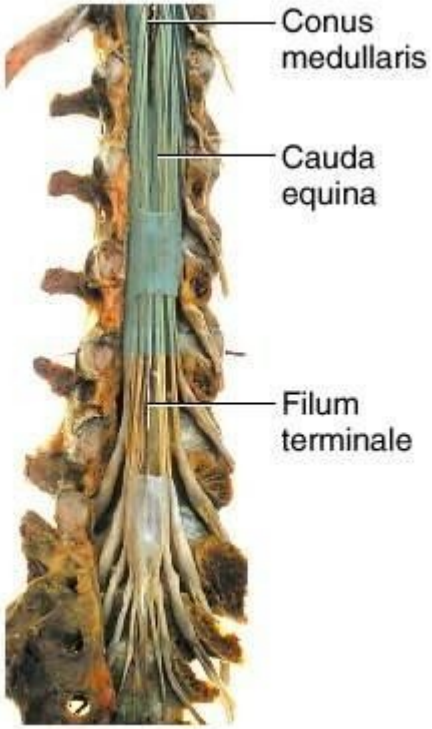
Typically ~18 inches in length

Deep anterior median fissure

Shallow posterior median sulcu

Conus medullaris (= end of cor

Cervical and lumbar enlargements



- **Filum Terminale extends to sacral vertebrae, joins coccygeal ligament, for length-wise stabilization.**

- **Cauda Equina - extension of ventral and dorsal roots (horses tail!).**

- **Denticulate Ligament (extension of dura to pia mater) for lateral (side to side) stabilization.**

Spinal Plexus:
(in the Nervous System)

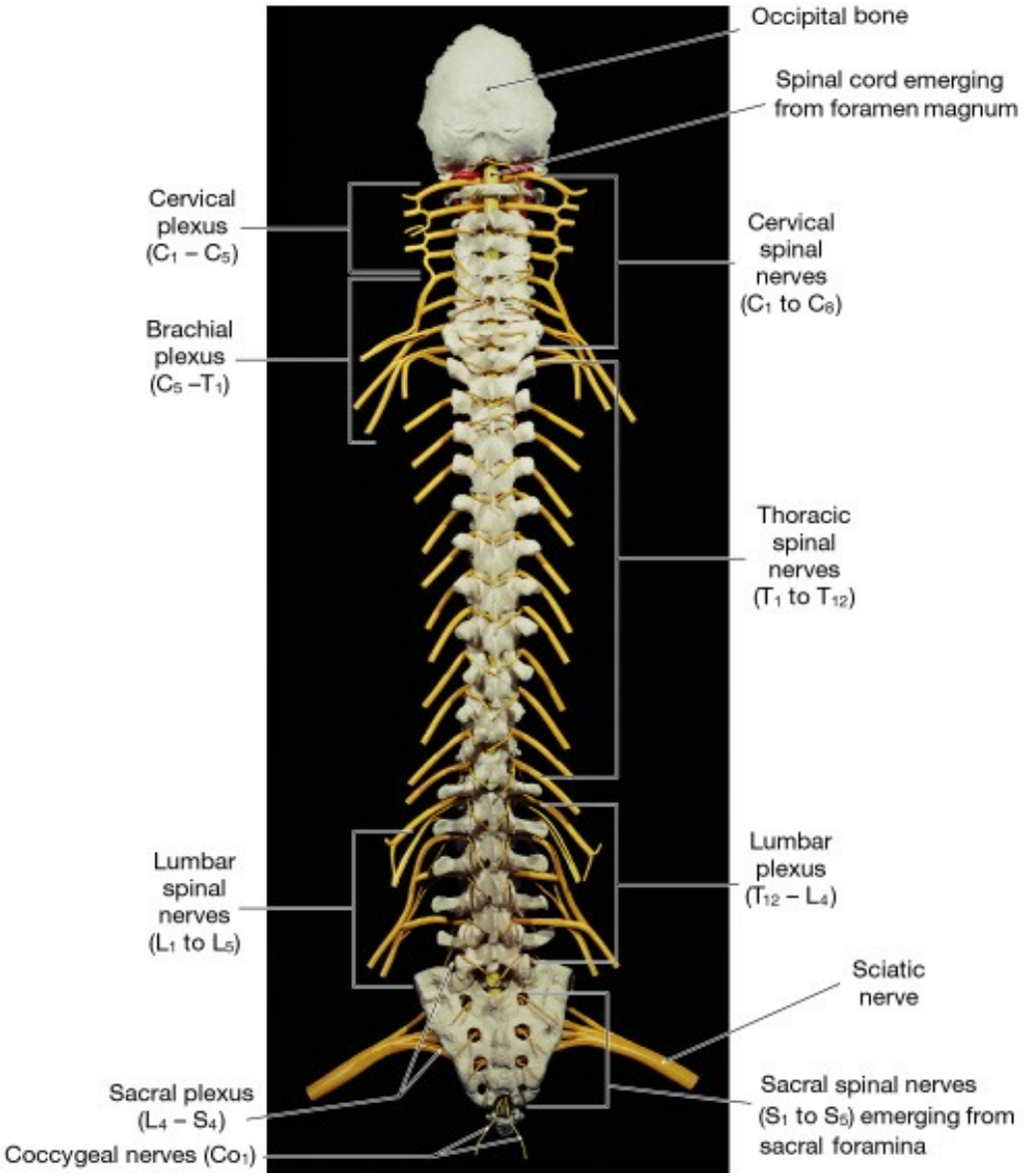
is a re-arrangement of spinal nerves into functional groups.

Cervical (C_1-C_5)

Brachial (C_5-T_1)

Lumbar (T_{12}-L_4)

Sacral (L_4-S_4)


Occipital bone
Spinal cord emerging from foramen magnum
Cervical plexus (C1 – C5)
Cervical spinal nerves (C1 to C8)
Brachial plexus (C5 –T1)
Thoracic spinal nerves (T1 to T12)
Lumbar spinal nerves (L1 to L5)
Lumbar plexus (T12 – L4)
Sciatic nerve
Sacral plexus (L4 – S4)
Coccygeal nerves (Co1)
Sacral spinal nerves (S1 to S5) emerging from sacral foramina

Cervical (C_1-C_5)

e.g. Phrenic n. (C_3-C_5)

Brachial (C_5-T_1)

e.g. Radial n. (C_{5-8}-T_1)

e.g. Ulnar n. (C_8-T_1)

e.g. Musculocutaneous n. (C_5-C_7)

e.g. Median n. (C_{5-8}-T_1)

Lumbar (T_{12}-L_4)

e.g. Femoral n. (L_2-L_4)

e.g. Obturator n. (L_2-L_4)

Sacral (L_4-S_4)

e.g. Sciatic n. (L_4-S_3)

e.g. Tibial n. (L_4-S_3)

Spinal Meninges

- Dura Mater

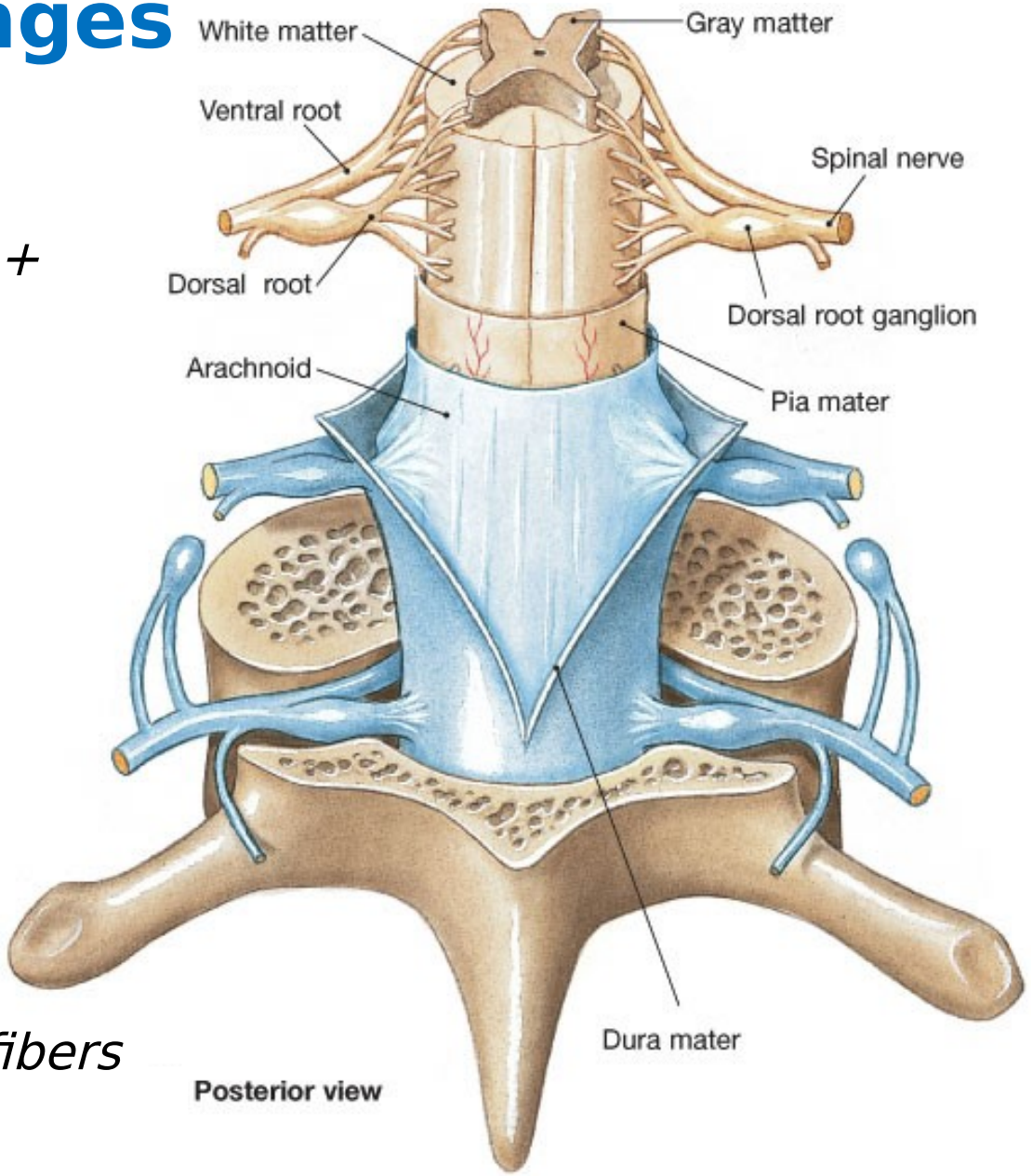
Dense irregular CT + Simple squamous epithelium

- Arachnoid

Simple squamous epithelium

- Pia Mater

Collagen and elastic fibers



Lumbar Puncture

For taking a sample of CSF from the subarachnoid space In the spinal meninges.

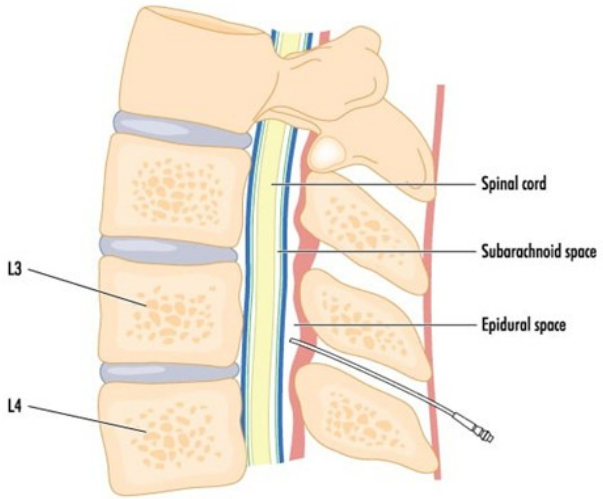
Done in the **Lumbar** region.
Why?

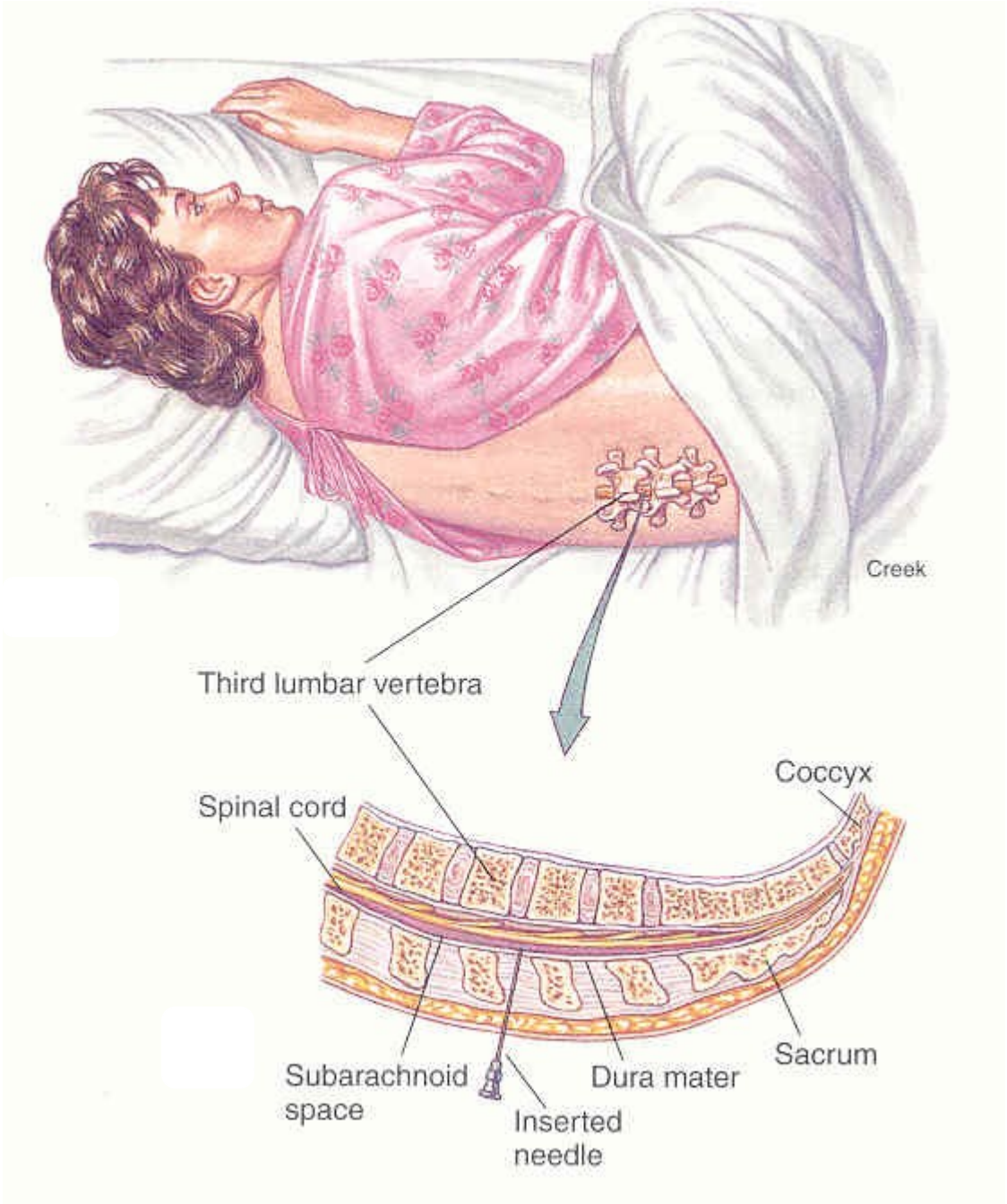
Where (at what vertebrae level) should the needle be inserted in order to avoid any chance of hitting the spinal cord?

Epidural Block

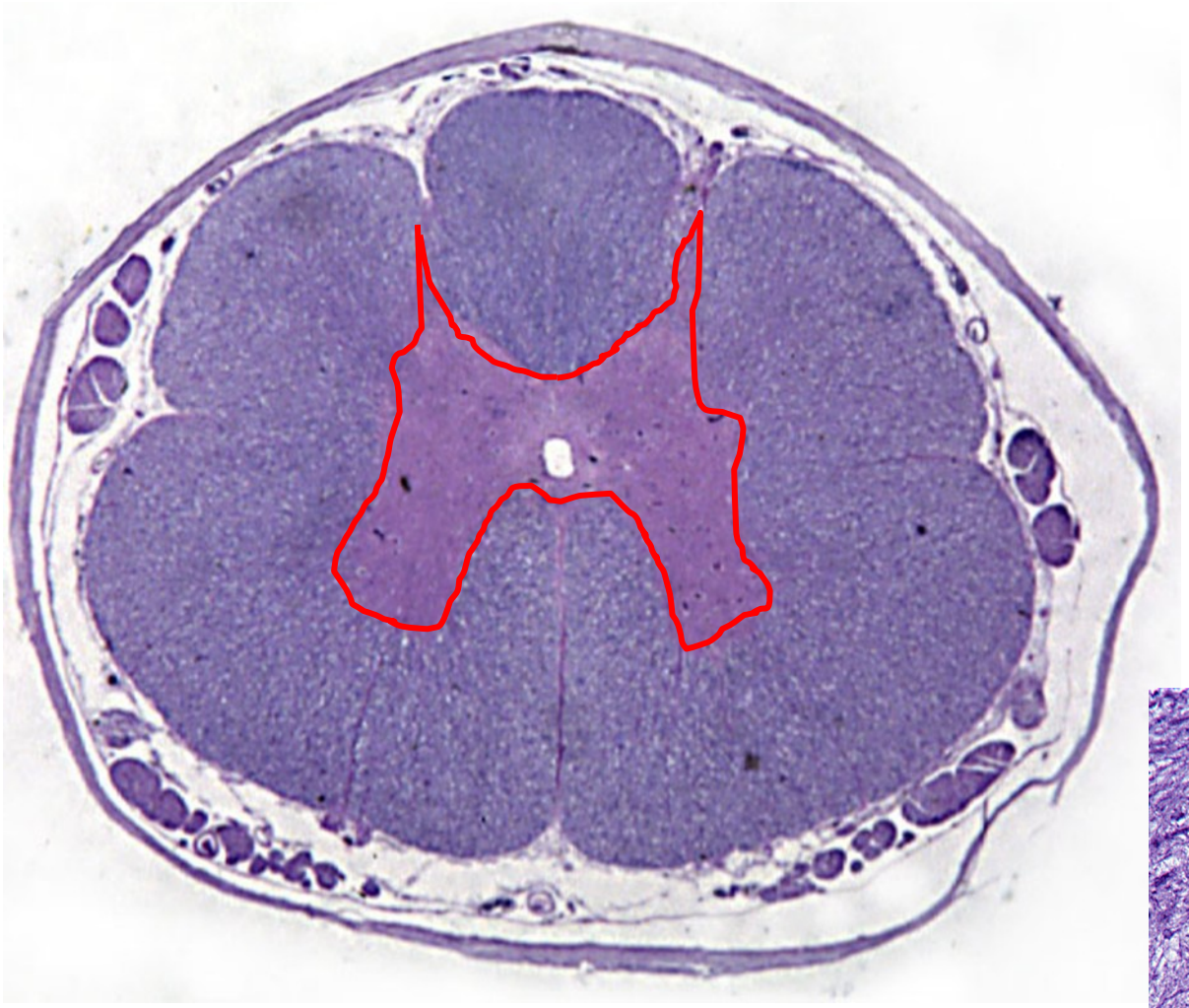
For placement of anesthetics into the epidural space of spinal meninges to block pain during child birth.

Note: The conus medullaris is located between L_1 and L_2.





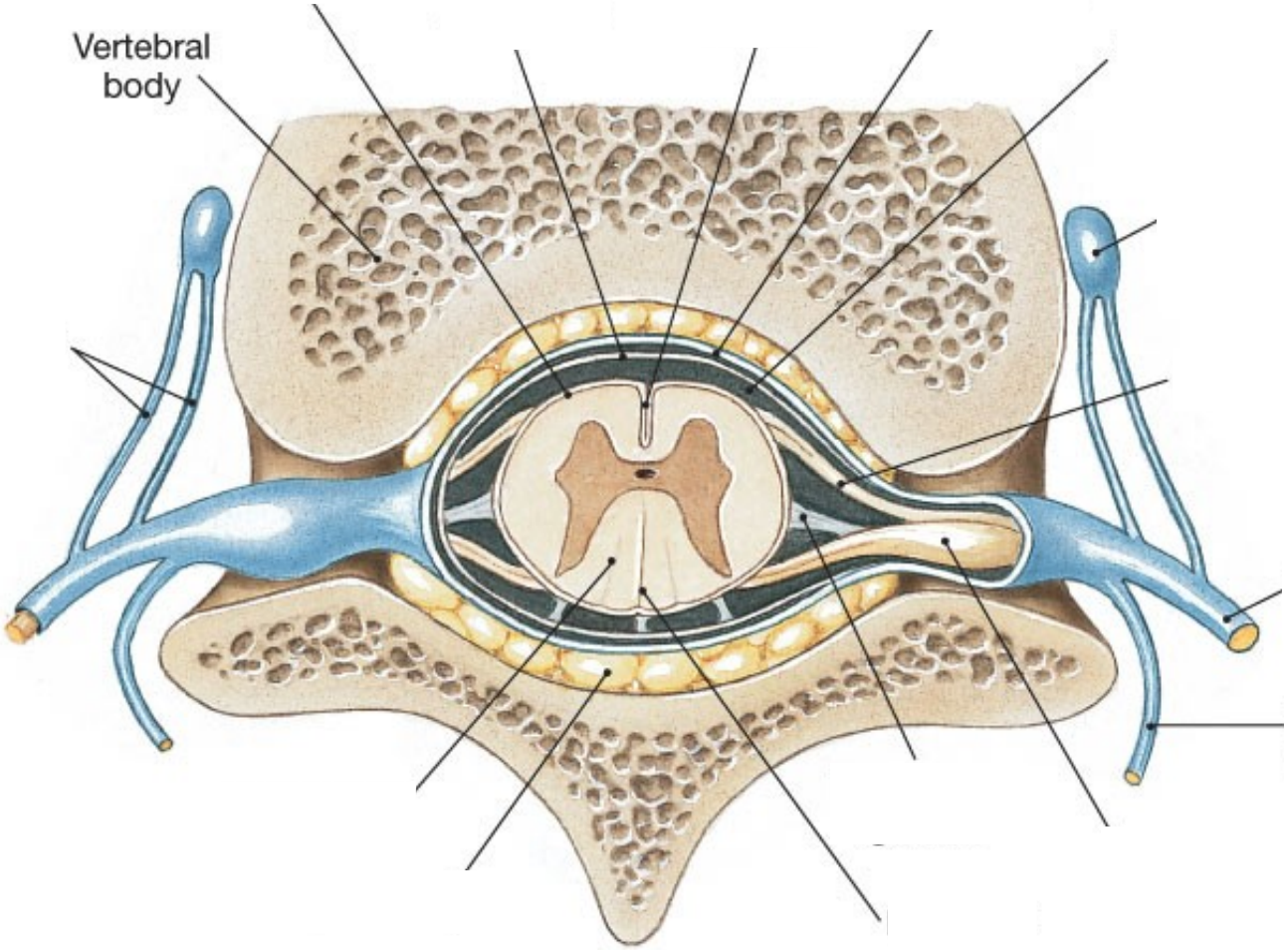
Cross Section of Spinal Cord Histology



Central Canal
filled with CSF lined with ependymal cells

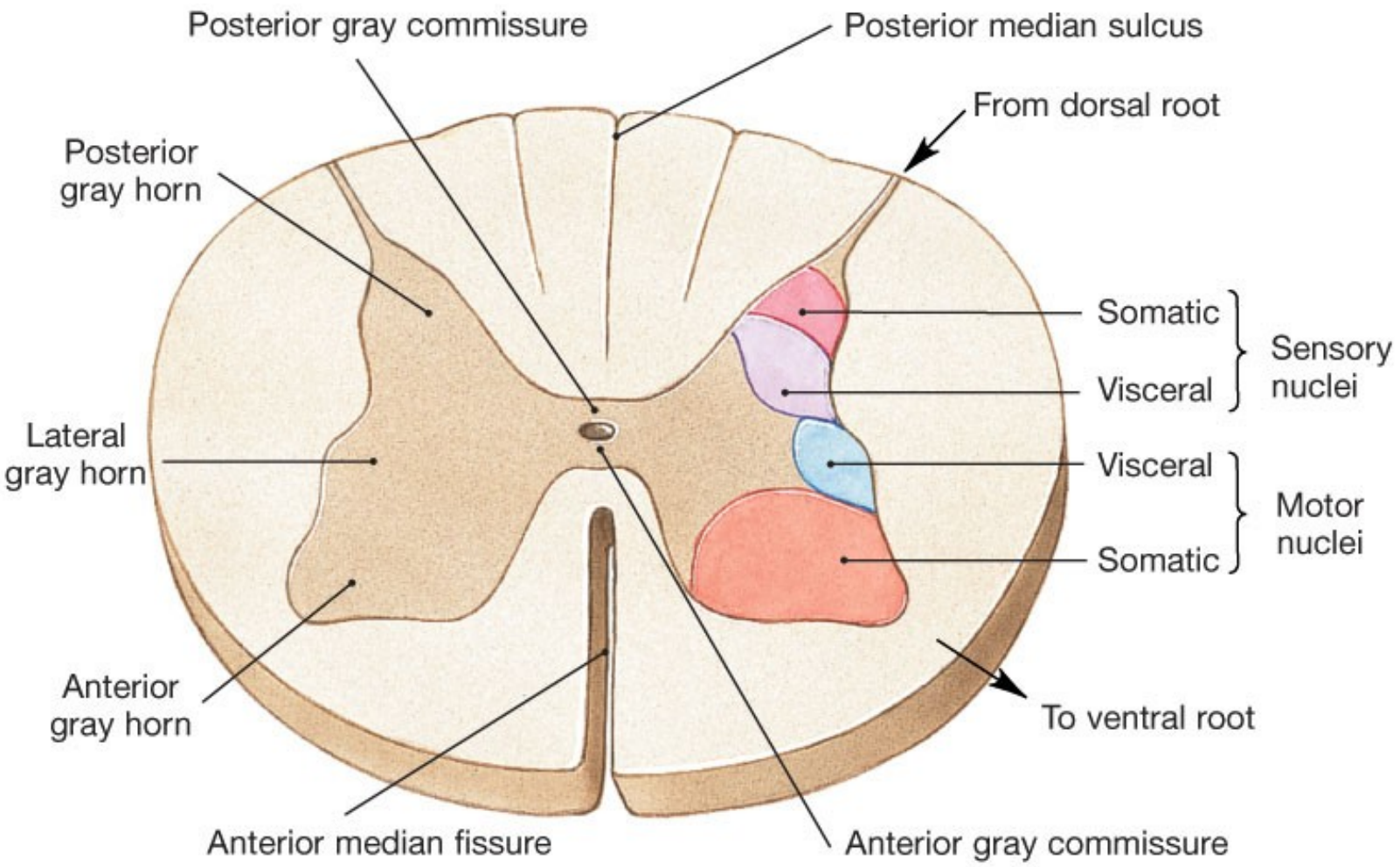
Now draw the x.s. of spinal cord!

Spinal Cord Anatomy (x.s.)



Superior view

The Spinal Cord Nuclei



The Spinal Cord Nuclei

Posterior gray horns:

Somatic and Visceral **Sensory** nuclei.

Anterior gray horns:

Somatic **Motor** control.

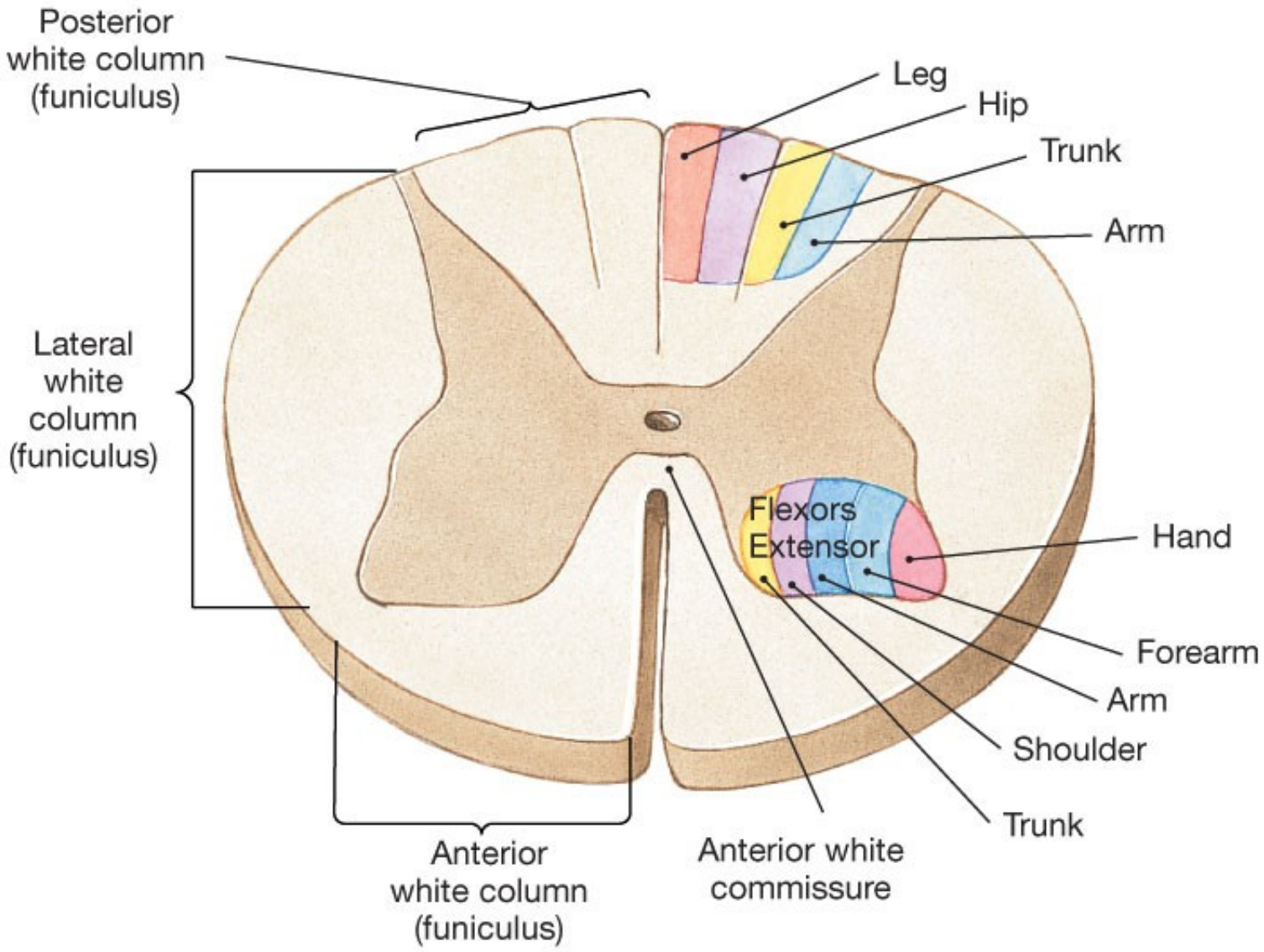
Lateral gray horns:

Visceral **Motor** neurons.

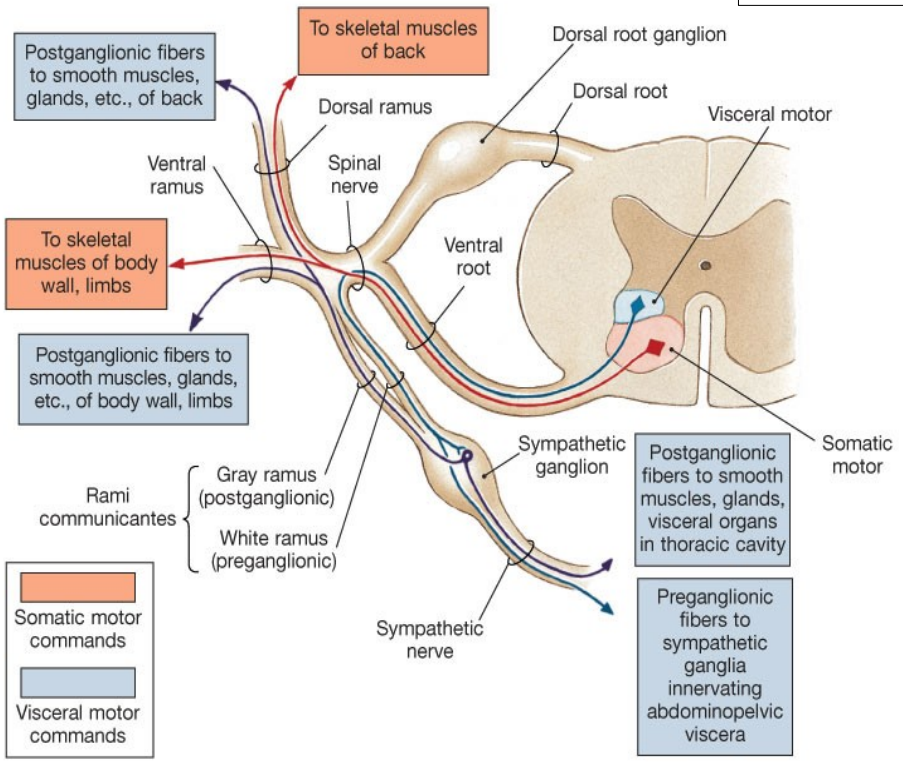
Gray commissures

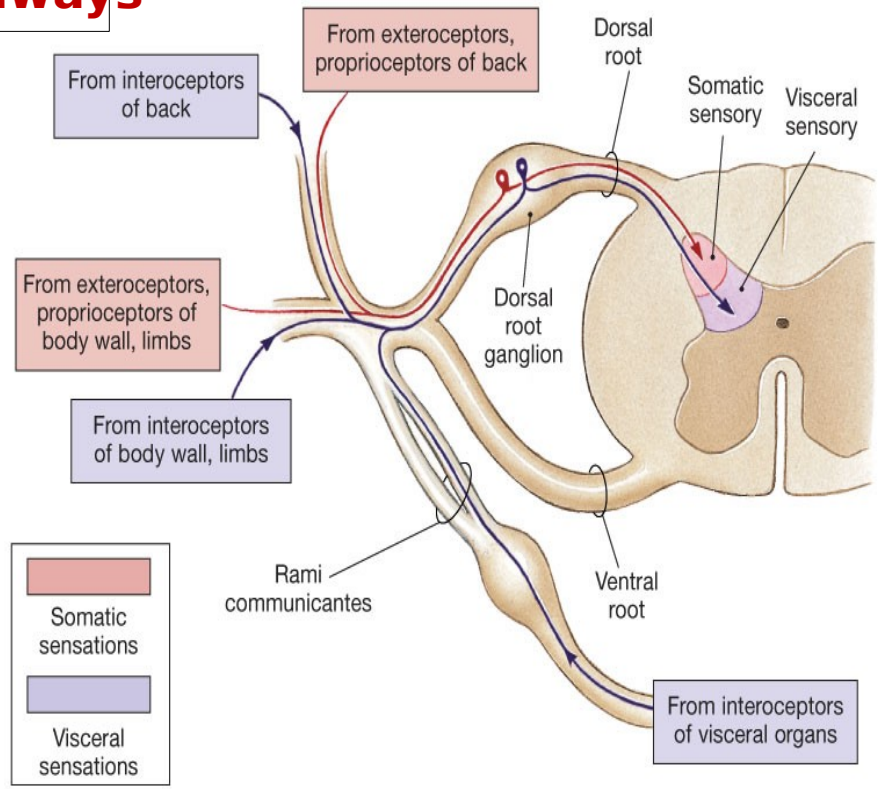
Axons of interneurons crossing and unmyelinated axons.

The Spinal Cord Nuclei

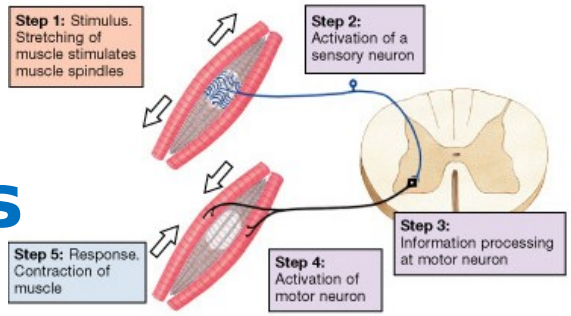


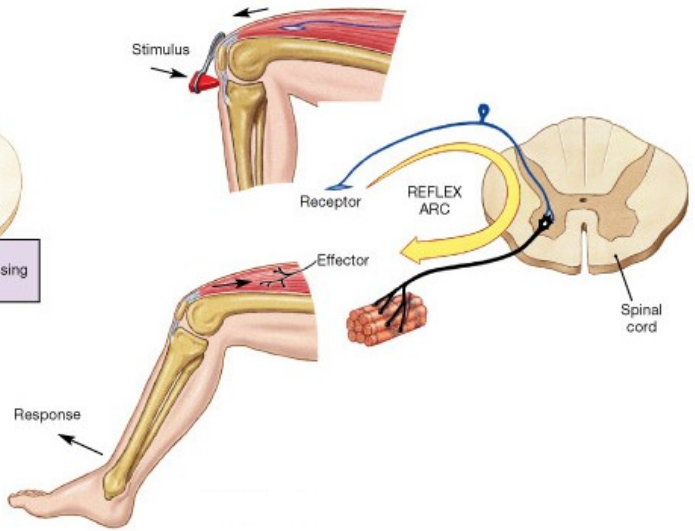
Spinal Pathways


Postganglionic fibers to smooth muscles, glands, etc., of back
To skeletal muscles of back
Dorsal root ganglion
Dorsal root
Dorsal ramus
Visceral motor
Ventral ramus
Spinal nerve
To skeletal muscles of body wall, limbs
Ventral root
Postganglionic fibers to smooth muscles, glands, etc., of body wall, limbs
Sympathetic ganglion
Somatic motor
Rami communicantes
Gray ramus (postganglionic)
White ramus (preganglionic)
Postganglionic fibers to smooth muscles, glands, visceral organs in thoracic cavity
Sympathetic nerve
Preganglionic fibers to sympathetic ganglia innervating abdominopelvic viscera
Somatic motor commands
Visceral motor commands



Spinal Reflexes


Step 1: Stimulus. Stretching of muscle stimulates muscle spindles
Step 2: Activation of a sensory neuron
Step 3: Information processing at motor neuron
Step 4: Activation of motor neuron
Step 5: Response. Contraction of muscle



Draw a monosynaptic spinal reflex

Lou Gehrig

Amyotropic Lateral Sclerosis (ALS)